

## **APPENDIX – CLAIMS AS AMENDED**

For the Examiner's convenience, the claims are presented below as amended:

1. A method for responding to a request to transfer an outgoing data frame from a virtual computer system to a computer network, the outgoing data frame comprising at least data to be transmitted and at least one of a layer 2 and layer 3 destination address, the virtual computer system comprising one or more virtual machines (VMs) executing on a host platform via virtualization software, the virtualization software comprising one or more layers of software interfacing between the VMs and the host platform, the virtual computer system further comprising a plurality of physical network interface cards (NICs), the method comprising the steps of:

obtaining access by a NIC manager to the outgoing data frame, the outgoing data frame being provided by one of the VMs, the NIC manager being a component of the virtualization software;

receiving, in the NIC manager, NIC management information related to one or more of the plurality of NICs;

receiving, in the NIC manager, VM-specific information related to one or more of the VMs in the virtual computer system; and

based on the NIC management information and the VM-specific information, selecting a NIC from the plurality of NICs and transferring the outgoing data frame to the computer network over the selected NIC.

2. The method of claim 1, in which the VM-specific information indicates an amount of network bandwidth that is allocated to the one of the VMs that provided the outgoing data frame.

3. The method of claim 67, in which the VM-specific information indicates an allocation to the one of the VMs that provided the outgoing data frame of an amount of network bandwidth and a the decision is made not to transfer the outgoing data frame when transferring the outgoing data frame would cause the allocation of network bandwidth to be exceeded.

4. The method of claim 1, in which the VM-specific information indicates a priority of the one VM relative to the priorities of other ones of the VMs.

5. The method of claim 1, in which the NIC management information indicates which one or more of the plurality of NICs is available for the transfer of the outgoing data frame.

6. The method of claim 5, in which the NIC management information further indicates a pending data transfer load for each of the plurality of NICs that are available for the transfer of the outgoing data frame.

7. The method of claim 1, in which a load distribution function is used in performing the selecting of the NIC over which to transfer the outgoing data frame.

8. The method of claim 7, wherein:  
the one or more VMs comprises at least a first VM and a second VM and the plurality of NICs comprises at least a first NIC and a second NIC; and

the load distribution function substantially always routes outgoing data frames provided by a first VM over a first NIC as long as the first NIC is available, and substantially always routes outgoing data frames provided by a second VM over a second NIC as long as the second NIC is available, and routes outgoing data frames provided by the first VM over the second NIC

if the first NIC is not available, and routes outgoing data frames provided by the second VM over the first NIC if the second NIC is not available.

9. The method of claim 8, in which the outgoing data frames provided by the first VM are distinguished from outgoing data frames provided by the second VM by reference to a source physical address contained in a header of each outgoing data frame.

10. The method of claim 1, in which the NIC management information indicates whether a failover is occurring on one of the NICs.

11. The method of claim 10, in which the one VM is temporarily suspended if a failover is occurring on the one of the NICs.

12. (Canceled.)

13. The method of claim 67, wherein, if a decision is made not to transfer the data, a further decision is made whether to suspend the one VM.

14. The method of claim 1, wherein, if a decision is made not to transfer the data, a further decision is made whether to migrate the one VM to another computer system.

Claims 15-29 (Canceled.)

30. A method for responding to requests to transfer outgoing data frames from a virtual computer system to a physical computer network, the virtual computer system comprising a first VM and a second VM, the virtual computer system also comprising a first physical

network interface card (NIC) and a second physical NIC for connecting to the computer network, the method comprising the steps of:

- determining that one of the first and second physical NICs is not available for transferring data;

- determining that one of the first and second VMs has a higher priority than an other of the first and second VMs; and

- for each of the outgoing data frames:

- determining whether the first VM or the second VM provided the outgoing data frame; and

- transferring the outgoing data frame over an available one of physical NICs if the one of the VMs having higher priority provided the outgoing data frame; and

- discarding the outgoing data frame if the other of the VMs provided the outgoing data frame.

#### Claims 31-48 (Canceled)

49. The method of claim 30, further comprising suspending the other of the VMs in response to determining that the one physical NIC is not available.

50. The method of claim 30, further comprising migrating the other of the VMs to another computer system in response to determining that the one physical NIC is not available.

51. A computer program embodied in a tangible, computer-readable medium, the computer program performing a method for responding to a request to transfer an outgoing data frame from a virtual computer system to a computer network, the outgoing data frame comprising at least data to be transmitted and at least one of a layer 2 and layer 3 destination

address, the virtual computer system comprising one or more virtual machines (VMs) executing on a host platform via virtualization software, the virtualization software comprising one or more layers of software interfacing between the VMs and the host platform, the virtual computer system further comprising a plurality of physical network interface cards (NICs), the method comprising the steps of:

obtaining access by a NIC manager to the outgoing data frame, the outgoing data frame being provided by one of the VMs, the NIC manager being a component of the virtualization software;

receiving, in the NIC manager, NIC management information related to one or more of the plurality of NICs;

receiving, in the NIC manager, VM-specific information related to one or more of the VMs in the virtual computer system;

based on the NIC management information and the VM-specific information, selecting a NIC from the plurality of NICs and transferring the outgoing data frame to the computer network over the selected NIC.

52. The computer program of claim 51, in which the VM-specific information indicates an amount of network bandwidth that is allocated to one of the VMs that provided the outgoing data frame.

53. The computer program of claim 69, in which the VM-specific information indicates an allocation to the one of the VMs that provided the outgoing data frame of an amount of network bandwidth and the decision is made not to transfer the outgoing data frame when transferring the outgoing data frame would cause the allocation of network bandwidth to be exceeded.

54. The computer program of claim 51, in which the VM-specific information indicates a priority of the one VM relative to priorities of other ones of the VMs.

55. The computer program of claim 51, in which the NIC management information indicates which one or more of the available plurality of NICs is available for the transfer of the outgoing data frame.

56. The computer program of claim 55, in which the NIC management information further indicates a pending data transfer load for each of the plurality of NICs that are available for the transfer of the outgoing data frame.

57. The computer program of claim 51, in which a load distribution function is used in performing the selecting of the NIC over which to transfer the outgoing data frame.

58. The computer program of claim 57, wherein:  
the one or more VMs comprises at least a first VM and a second VM and the plurality of NICs comprises at least a first NIC and a second NIC; and

the load distribution function:

substantially always routes outgoing data frames provided by a first VM over a first NIC as long as the first NIC is available;

substantially always routes outgoing data frames provided by a second VM over a second NIC as long as the second NIC is available;

routes outgoing data frames provided by the first VM over the second NIC if the first NIC is not available; and

routes outgoing data frames provided by the second VM over the first NIC if the second NIC is not available.

59. The computer program of claim 58, in which the outgoing data frames provided by the first VM are distinguished from outgoing data frames provided by the second VM by referring to a source physical address contained in a header of each outgoing data frame.

60. The computer program of claim 51, in which the NIC management information indicates whether a failover is occurring on one of the NICs.

61. The computer program of claim 60, in which the one VM is temporarily suspended if a failover is occurring on the one of the NICs.

62. The computer program of claim 69, wherein, if a decision is made to not transfer the outgoing data frame, a further decision is made whether to suspend the one VM.

63. The computer program of claim 69, wherein, if a decision is made to not transfer the outgoing data frame, a further decision is made whether to migrate the one VM to another computer system.

64. A computer program embodied in a tangible, computer-readable medium, the computer program performing a method for responding to requests to transfer outgoing data frames from a virtual computer system to a physical computer network, the virtual computer system comprising a first VM and a second VM, the virtual computer system also comprising a first physical network interface card (NIC) and a second physical NIC for connecting to the computer network, the method comprising:

determining that one of the first and second physical NICs is not available for transferring data;

determining that one of the first and second VMs has a higher priority than an other of the first and second VMs; and

for each of the outgoing data frames:

determining whether the first VM or the second VM provided the outgoing data frame; and

transferring the outgoing data frame over an available one of the physical NICs if the one of the VMs having higher priority provided the outgoing data frame; or

discarding the outgoing data frame if the other of the VMs provided the outgoing data frame.

65. The computer program of claim 64, wherein the method further comprises suspending the other of the VMs in response to determining that the one physical NIC is not available.

66. The computer program of claim 64, wherein the method further comprises migrating the other of the VMs to another computer system in response to determining that the one physical NIC is not available.

67. The method of claim 1, further comprising:

deciding, based on the NIC management information and the VM-specific information, whether to transfer the outgoing data frame;

discarding the outgoing data frame if a decision is made not to transfer the outgoing data frame; and

performing the transferring of the outgoing data frame only if a decision is made to transfer the outgoing data frame.



68. The method of claim 1, wherein the NIC manager is additionally provided with access to outgoing network frames from components of the virtual computer system other than the VMs.

69. The computer program of claim 51, wherein the method further comprises:  
deciding, based on the NIC management information and the VM-specific information, whether to transfer the outgoing data frame;  
discarding the outgoing data frame if a decision is made not to transfer the outgoing data frame; and  
performing the transferring of the outgoing data frame only if a decision is made to transfer the outgoing data frame.

70. The method of claim 51, wherein the NIC manager is additionally provided with access to outgoing network frames from components of the virtual computer system other than the VMs.